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# BORDEN'S REVIEW *of* NUTRITION RESEARCH

Summaries and reviews of research information concerning the nutritive values of milk and milk products. Published by The Borden Company, 350 Madison Avenue, New York, N. Y.

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## *Quart of Milk Provides Large Portions of Daily Nutritive Essentials*

The basic factors which make milk the most important single food have become a part of the body of nutrition information. From time to time new research has added to, or further amplified, these facts. Advances in the several branches of the science of nutrition which have accomplished both more definite estimations of the nutritive requirements of man and accurate determinations of the comparative nutritive values of different foods, make possible an evaluation of the total contribution of a quart of milk to the daily food need.

The recent bulletin "Milk as a Food Throughout Life" published by the University of Wisconsin Experiment Station has brought together, for general distribution, a summary of this information both new and old. The unchallenged place of milk as a food is described in the bulletin as follows:

> . . . it is only within the last century that this age-old custom of using milk has been put on a sound scientific basis.
>
> Science has begun to examine milk, to look inside the bottle, inside the milk itself, and see what's there. Science has found that milk more than any other single food meets the nutritional needs of the body. It contains protein, carbohydrate, fat, minerals, vitamins and water. And it contains these recognized dietary essentials in suitable proportions. Milk is not a beverage in the class with a glass of water or a cup of coffee—it is a food, and a good one. As the most nearly complete food, milk is without a competitor and is endorsed wholeheartedly by nutritionists everywhere.

### *Milk as the Sole Article of Diet*

Although milk is not commonly used as the sole article of diet except for the very young, its approach to nutritional completeness is demonstrated by the fact that milk alone, when suitably fortified with three essential minerals, has in many experiments with many species successfully sustained life and health over long periods. The Wisconsin bulletin discusses such experiments:

> When milk is fortified with small amounts of three mineral elements, iron, copper and manganese, and for children with vitamin D it can be used as the sole article of diet. At the Wisconsin Agricultural Experiment Station many animals, including rats, dogs and pigs, have grown to maturity and maintained health on a diet of fortified milk alone. Indeed, for three months one winter several men students lived

on raw milk supplemented with the missing minerals and with orange juice. They drank as much milk as they wanted—usually three and one-half to four and one-half quarts a day. They maintained their weight, in fact some of the boys gained, and they all felt well and satisfied. As one boy put it, "I can even pass a restaurant and smell beefsteak cooking with no desire to turn in."

## *Forty Generations of Experimental Animals Raised in Superior Health on Diet Providing Extra Milk*

The absence or presence of milk in the diet may mean the difference between passable health and superior health, the Wisconsin bulletin explains, referring to Sherman's experiments:

> . . . The value of milk as a supplement to other foods has been demonstrated by Professor Henry Sherman . . . of Columbia University, who has conducted a very practical and intensely interesting experiment in his laboratory. For years he has fed two colonies of rats on dietary regimes alike in all respects except that one diet contains one-sixth dried whole milk and the other one-third dried whole milk. Animals have been continued on these diets for more than forty generations.
>
> The rats that received one-sixth dried whole milk have grown very well, reproduced normally, raised their young, and in general have been able to maintain their health throughout life. Their condition might be described as *satisfactory*. But the colony that received the better diet, the one containing one-third dried whole milk, can be described as *superior* instead of *satisfactory*. These rats have grown better, matured earlier, given birth to a larger number of more vigorous young, and a larger proportion of the young have been successfully reared to maturity. They have shown in every way a greater degree of positive health than the merely *satisfactory* colony. But most interesting of all is the fact that, although the rats of this colony matured earlier, they lived longer and showed signs of senility much later than the first colony. . . .
>
> The concentrated preparations of vitamins, minerals, and what not have their justification when recommended by physicians, but they are not daily necessities when the diet is based on the proper proportions of milk, meat, eggs, vegetables, and fruit. These are the natural foods, the ones that have not been improperly heated and treated and processed until they can no longer be recognized. The more processing our foods undergo, the greater is our need for a few natural, protective foods. Milk is one of the best of these, so let us examine milk, let us get acquainted with its nutritional virtues and its nutritional shortcomings. Such knowledge will enable us to use milk as an aid to better nutrition, better health and better living.

## *The Nutritive Value of a Quart of Milk*

The layman whose interest in nutritive requirements is the practical one of obtaining energy and tissue-building needs and protecting health commonly thinks of milk in terms of quarts and of nutrition in terms of a day's requirements—three adequate meals. Tables have been compiled showing a comparison of requirements of average normal adults for the various nutritive essentials and the amounts of these nutrients supplied in a quart of milk. One of the most up-to-date of such tables is that published in the Wisconsin bulletin and herewith reprinted:

NUTRITIVE ELEMENTS IN MILK AND HUMAN REQUIREMENTS

| *Nutritional Factor* | *Average Daily Requirement for a 154 lb. Adult* | *Amount in 1 Quart of Milk* | *Approximate portion of the daily requirement supplied by 1 quart of whole milk* |
|---|---|---|---|
| Protein | 70 gm | 31 gm | 1/2 |
| Calories | 3000 cal | 665 cal | 1/5 |
| Calcium | 0.68 gm | 1.15 gm | 2 |
| Phosphorus | 1.32 gm | 0.9 gm | 2/3 |
| Iron | 15 mg | 0.2 to 0.5 mg | 1/30 |
| Vitamin A | 3000 to 6000 I.U. | 900 to 1800 I.U. | 1/3 |
| Thiamin | 250 to 300 I.U. | 60 I.U. (raw milk) | 1/5 |
| Ascorbic Acid | 500 I.U. | 520 I.U. (raw milk) | 1 |
| Vitamin D | 400 I.U. (for children) | 40 I.U. (summer milk) | 1/10 |
| Nicotinic Acid | 10 to 15 mg | Roughly 4 to 12 mg | 1/3 |
| Riboflavin | 1 to 2 mg | 2 to 2.5 mg | 1 |

## *Better Health, Longer Active Life-Span*

The effects of a decreasing birth rate in this country and the consequent raising of the average age level of the population as a whole presents a number of potential social and economic problems which could be offset, at least to some extent, by increasing the number of active years. There is experimental evidence that such an increase in number of useful years of the adult may be accomplished by improved nutrition.

> Perhaps it is possible, by dietary means, to lengthen the period of maturity and postpone the period of old age. Under present social conditions the period of formal education and preparation of a man for his life work is long and arduous, especially in the professions. If, then, instead of being "laid on the shelf" at 60 as is so often the case, a man could continue to function through an extended period of maturity in full vigor, in vital physical and mental health until, let us say, 80 years of age, then indeed the science of nutrition will have made a real contribution to society.

## *Vital Factors from Foods Save Cost of Pills*

Pure oxygen has its place in medical practice to meet respiratory emergencies. Yet the normal means of obtaining oxygen, for the normal healthy person, is by inhalation of the air. The proved value of pure oxygen in emergencies does not warrant the healthy person's inhabiting the oxygen tent. Similarly, the pharmaceutical vitamin preparations have proved their value in treatment of certain pathological conditions, but the normal means of obtaining nutritive essentials to maintain health is the ingestion of a suitable diet. On this subject the Wisconsin bulletin says:

> To read some of the present day advertisements, one would think that all one needed to do to be suddenly transformed into a magnificent specimen of humanity is to take a certain pill or a particular capsule. Believing in a fairy godmother with a magic wand may be a pleasant illusion, but it is not scientific. Is it not more pleasant, as well as more scientific, to avoid the need for massive doses of any one nutritional factor by the simple and sensible procedure of eating a well-balanced diet? A good diet gives automatic protection and there is no need to make up shortages.

## *Milk Supplies Calcium and Phosphorus for Bone Building, Growth and Maintenance*

The Wisconsin bulletin points out that at least 50% of the children living in the northern part of the United States have at some time suffered a mild form of rickets, usually the result of inadequate calcium or Vitamin D. The practical advantages of milk over that of any other food as the main source of calcium in the diet of persons of all ages, and the health benefits of adequate calcium for adults as well as children, are outlined:

> . . . Calcium is sure to be lacking in a diet of meat, potatoes, bread, pie and coffee. Milk and green vegetables are our richest sources of calcium.
>
> It has been determined by experiments on human beings that an adult man needs to eat 0.68 grams of calcium per day . . . if he is to get by without drawing on his savings account of calcium, the calcium already stored in his bones and teeth. A growing child needs still more, for he must add to his savings account, and in order to do so should eat at least 1.0 gram of calcium a day. A pregnant or nursing mother should have as much calcium as a growing child or even more if she is producing a large quantity of milk.
>
> An adult man needs approximately 1.32 grams of phosphorus a day, a child 1.0 gram per day and a pregnant or nursing mother as much as an adult man. . . .
>
> A quart of milk contains 1.15 grams of calcium and 0.9 grams of phosphorus. . . . These figures explain in cold hard facts why the nutritionists advocate a quart of milk a day for every growing child and nursing mother, and at least a pint a day for every adult. A pint of milk does not supply the phosphorus needed, but phosphorus is found in abundance in many common foods, a truism which does not hold for calcium.
>
> Milk then, can be regarded as one of the best and easiest sources of dietary calcium. Surely it is easier to drink a pint (two glasses) of milk a day than it is to eat three-fourths of a pound of kale, or two and one-half pounds of chard or three pounds of green string beans. These quantities of foods contain approximately equivalent amounts of calcium. Most other foods contain far less calcium than kale, chard or beans. This does not mean that we should not also use green foods for calcium as they are rich in this element compared with many other foods.

## *Iron, Copper and Manganese*

It is seldom that a healthy adult requires iron in addition to that present in a well selected diet. For those depending largely on milk alone for their food, the situation is different, for it has been demonstrated, that milk does not contain enough iron and copper to prevent nutritional anemia if it is used as the sole article of diet beyond the suckling period.

The iron content of milk varies somewhat, but the majority of samples contain between 0.2 and 0.5 milligrams per quart. The copper and manganese requirements of human beings are not accurately known, but the average mixed diet apparently contains an adequate supply of those elements. Milk contains approximately 0.15 milligram of copper and 0.02 milligram of manganese per quart.

## *Milk Supplies Important Vitamins*

Milk is recognized as one of the best practical food sources of Vitamin A and Riboflavin (Vitamin $B_2$ or G), as an ideal carrier for supplementary Vitamin D, and as carrying at least significant amounts of all other vitamin factors required for growth and health.

## *Milk for Vitamin A*

The abundance of Vitamin A in milk may be looked upon historically as the starting point of present day vitamin knowledge. Nutrition information on Vitamin A is related in the Wisconsin bulletin as follows:

> Vitamin A helps maintain normal conditions in the surface tissues of the body. Without it these tissues become horny, flaky, dried up, or as the scientists say, "keratinized." It is this keratinization of the cornea of the eye, for instance, which results in the eye disease characteristic of vitamin A deficiency known as xeropthalmia. It is this same drying up of the skin, of the surface tissue of the respiratory tract and of the genito-urinary tract which makes these surfaces more susceptible to infection. This property of vitamin A has earned for it the term, anti-infective vitamin.
>
> Will vitamin A prevent colds? This is a question often asked. The scientific data show just this—if one has plenty of vitamin A in the diet, additional amounts will neither prevent nor cure a cold. If, on the other hand, there is a deficiency of this vitamin, the resistance of the body will be lowered, the mucous membranes will be more subject to the invasion of infective organisms, and colds may result. . . .
>
> Extensive tests at this Station prove that ordinary market milk carrying 3.5% of fat, will supply between 900 and 1800 International units of vitamin A activity per quart, the smaller amount occuring in late winter and the larger in late summer. . . . If, then, one could obtain milk and butter of the highest vitamin A content, one quart of milk and one ounce of butter would provide a goodly portion of the daily vitamin A requirement.

## *Milk for Vitamin $B_1$*

Milk as a source of Vitamin $B_1$ is discussed as follows:

> Thiamin is the new and chemically significant name for vitamin $B_1$, the anti-neuritic vitamin. Without thiamin there is a distinct loss of the urge to eat, a decrease in the secretion of the digestive juices, and a lack of activity in the stomach and intestines. Dr. George R. Cowgill . . . of Yale University, a man who has done a great deal of work on thiamin, estimates that 80 International units . . . are needed daily by an infant, 280 by an average-sized adult, and around 600 during pregnancy and lactation. The Council on Pharmacy and Chemistry of the American Medical Association is a little more conservative in stating that 50 units is the minimum for infants and 200 for adults.
>
> Milk is a good source of thiamin, and in contrast with the vitamin A, the thiamin content of milk does not vary with the season and the cow's ration; in fact, it is surprisingly constant. Thiamin can be synthesized by bacteria in the rumen of the cow so that a deficiency of thiamin is prevented, and if additional vitamin is fed, some physiological limitation prevents it being secreted into the milk. Sommer . . . gives an average figure of 60 International units per quart of milk. Thiamin is somewhat affected by heat, so that any heat treatment of milk, such as pasteurization or evaporation, may cause partial destruction of the vitamin.

## *Milk Contributes to Vitamin C Quotas*

Potency of Vitamin C in milk is lowered by processing, but recent advances of methods of pasteurization have reduced this loss. To assure adequate Vitamin C other sources of this vitamin should be included in the daily diet.

These facts are summarized in the Wisconsin bulletin:

> Raw cow's milk contains an average of 26 milligrams of ascorbic acid per liter, which would be 520 International units . . . Thus milk is an important source of vitamin C for farm children who drink raw milk. Since ascorbic acid is easily destroyed by heat, in the presence of air, some other source of it such as orange juice or tomato juice should be included in the diet of children or infants who are drinking pasteurized or boiled milk. . . .

## *Milk Ideal for Extra Vitamin D*

As a result of development of methods of fortifying milk with extra Vitamin D and because of the unique physiological advantages of milk as a carrier of Vitamin D—notably the calcium and phosphorus content of milk—milk so fortified is recommended as an ideal Vitamin D food. The following paragraphs on milk and Vitamin D are quoted from the Wisconsin bulletin:

> . . . Dr. Jeans at Iowa University found that 400 International units . . . daily of animal-source vitamin D supplied as vitamin D milk or cod liver oil was sufficient for infants. . . . This amount may be more than the minimum requirement for many experiments have shown that 135 International units in milk will prevent rickets in the normal infant. . . .
>
> The amount of vitamin D in milk varies with the conditions under which it is produced, ranging from 13 to 40 International units per quart. . . . The values tend to approach the lower limit in winter and the upper limit in summer when the cows are on pasture and in the sunlight. Although milk as it comes from the cow does not contain enough vitamin D to be effective in preventing rickets, it can be enriched sufficiently to do so. Various kinds of vitamin D milk are available in many of our large cities. Actual trials on humans have been made, and have established beyond doubt that these milks are exceptionally valuable as a food for infants and growing children. Vitamin D milk provides in the same product the calcium and phosphorus required for bone structure and the vitamin required for bone formation.

## *Milk for Riboflavin and Other B Complex Vitamins*

So important is milk as a source of Riboflavin that milk was one of the first foods to yield this flavin in pure form. This growth vitamin originally was called "lactoflavin" upon its isolation from milk. A quart of milk supplies the daily adult Riboflavin requirements. Information on Riboflavin and other vitamins of milk is outlined by the Wisconsin writers:

> The physiological effects of a deficiency of riboflavin are those which were once attributed to a lack of vitamin $B_2$ or G, the vitamin associated with growth. Riboflavin, a yellow substance with a characteristic green fluorescence, was first isolated from milk. The amount of the vitamin in cow's milk depends to some extent upon the amount in the feed, although, as found at this Station, it is very constant in market milk, one quart containing from 2 to 2.5 milligrams. . . . A quart of milk, then, would

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supply the daily requirements of man, for estimates indicate that 1 to 2 milligrams are needed.

Research has now established the fact that the water-soluble vitamin factor nicotinic acid is essential in the diet to prevent pellagra. An important part of the work that led to present understanding of the role of nicotinic acid in the prevention and treatment of pellagra was done at the Wisconsin Experimental Station. How milk helps protect against pellagra is explained:

## NICOTINIC ACID PREVENTS PELLAGRA

Human pellagra is a nutritional disease which, in certain sections of the South and at certain times of the year, is perhaps the major medical problem of the district. It is common among people whose diet is composed largely of salt pork, corn meal, flour and molasses. . . .

. . . nicotinic acid has been tested on many cases of human pellagra. The response of these patients is dramatic. Frequently within 12 hours after the vitamin is administered definite healing can be observed. Within a few days a patient who has been bed ridden for months is up and about. . . .

. . . Seldom do we see a case of uncomplicated nicotinic acid deficiency as we see it in controlled laboratory animals. Cures are therefore most effective and permanent when the administration of nicotinic acid is followed by a complete revision of dietary habits. . . .

. . . Milk, then, is not a rich source of nicotinic acid, and does not supply very much of the 10 to 15 milligrams daily which has been estimated to be the human requirement. However, the daily intake of milk along with meat and vegetables will give complete protection against pellagra. Milk may not supply enough nicotinic acid to cure pellagra after it develops, but it is an excellent supplement to the pellagrin's diet because of its protein and riboflavin content.

## OTHER VITAMINS FOUND IN MILK

### FACTORS IN VITAMIN B COMPLEX

Advancement of knowledge in the "vitamin B complex" field has led to the recognition of several different nutritional factors. Of these, thiamin, riboflavin and nicotinic acid are well-known chemically, but knowledge of the others is still in that indeterminate state which characterizes a newly discovered vitamin. The nutritional factors which are recognized are (1) a rat anti-paralytic factor $B_4$, (2) a rat anti-dermatitis factor $B_6$, which has been identified chemically, (3) factor W, a substance which is essential if riboflavin is to function and growth ensue, and (4) pantothenic acid, a chick anti-dermatitis factor. The significance of these vitamins in human nutrition is not known at present, but will doubtless be elucidated in the future. Because deficiencies of these four factors do not appear when animals are fed whole milk diets, we may conclude that they are present, at least in small amounts, in milk.

### VITAMIN E RELATED TO REPRODUCTION

Vitamin E is necessary for reproduction in rats, but very little of a definite nature is known as to the role it plays, if any, in preventing human sterility. That milk contains this factor is proven by the fact that rats fed exclusively on mineralized milk reproduce normally without additional supplements of vitamin E.

VITAMIN K AIDS COAGULATION OF BLOOD

A new vitamin, namely vitamin K, was named for the word "Koagulation" by its Danish discoverer, Dam, coagulation being spelled with a K in the German and Scandinavian languages. This vitamin is necessary for the coagulation of the blood, and is being used clinically to promote blood-clotting and prevent hemorrhage. . . .

The average daily requirements of the normal individual are not known, and the amounts of vitamin K in various foods have not as yet been determined. Again, its presence in milk is shown by the fact that laboratory animals fed exclusively on mineralized milk have shown no need for supplements of vitamin K.

GRASS JUICE FACTOR IMPROVES WINTER MILK

Recent experiments at the University of Wisconsin . . . have shown that laboratory animals grow better on milk obtained in the summer than they do on winter milk. This seasonal change in the nutritive value of milk can be related directly to a factor in fresh green grass which is transmitted to the milk. This so-called "grass juice factor" is not identical with any of the known vitamins but appears to be a new and different nutritional factor. The amount of it in a hay depends upon the conditions under which the hay is grown, the stage of growth when cut, and the method of drying. The relation of the grass juice factor to the nutrition of dairy cattle and to human beings is important to every dairy farmer.

## *Milk Proteins Supply Essential Amino Acids*

The quality of proteins supplied in milk are of greater significance than the quantity although one quart of milk will supply as much as one-half of the daily protein requirement of the adult. This is explained in the bulletin:

> Milk contains several different proteins, but only two of them, casein and lactalbumen, are present in nutritionally significant quantities. About 2.5% to 3.0% of whole milk is casein and 0.5% is lactalbumen. Casein is best known in the form of cottage cheese, and lactalbumen is the protein in whey. Both of these proteins are biologically complete; i.e., they contain suitable proportions of all of the essential amino acids. If either of these proteins is fed at a satisfactory level, it will support normal growth and reproduction, provided, of course, that the diet is adequate in other respects. The amino acid cystine is the limiting factor in the use of casein for growth in young animals. For this reason, when it is used as the only protein in the diet, more of it must be fed than would be necessary to supply the other essential amino acids.

Lactalbumen, on the other hand, contains more cystine than does casein, and when the two are used together, as in milk, they supplement each other excellently. The aim in efficient protein feeding is to combine proteins in such a manner that the amino acid deficiencies of one protein are made up by the surpluses of another. . . .

In an experiment with human beings, it was found that the average daily storage of protein in the body was 0.40 grams on a diet wherein the protein came from bread and milk, and 0.55 grams when milk alone supplied the protein. . . . These experiments and others like them prove that the proteins of milk are especially well constituted for use in the body, and further that they are of inestimable value in supplementing the less adequate proteins of the cereal grains. There is a real reason then for bread and milk.

## *Carbohydrate of Milk is Unique*

The carbohydrate of milk is a sugar, lactose. Its nutritive qualities have been widely studied. It is important not only as a source of energy but because of its effects on other physiological processes, such as its favorable effect on calcium utilization, and as an aid in promoting intestinal hygiene. Some of the outstanding facts about lactose are outlined by the Wisconsin writers.

Milk contains only one carbohydrate, lactose, a sugar which has nutritive properties not possessed by other sugars. Upon digestion, lactose is broken into two simple sugars, glucose and galactose, and as such is absorbed into the blood stream. The rate of digestion, or hydrolysis, of lactose is slower than that of other sugars, and consequently its presence persists in the intestinal tract for a longer period during digestion than other sugars. This is of distinct advantage to the animal for several reasons. In the first place, lactose favors the growth of *Lactobacillus acidophilus* and promotes carbohydrate fermentation. Fermentations of this type are desirable because they produce an acid reaction of the intestinal contents. This in turn reduces the formation of toxic decomposition products due to protein putrefaction. Secondly, it is known that lactose favors calcium assimilation. Pediatricians have often made the observation that breast-fed infants rarely have rickets. In this connection, it is interesting to note that the solids of human milk contain about 55% of lactose, whereas the solids of cow's milk contain 40% of lactose.

The addition of lactose to the diet of rachitic rats increases the absorption of calcium and phosphorus. . . . Further it has been shown that adding lactose to a rickets-producing diet fed to chicks will increase the acidity of the intestinal tract . . . and if lactose is fed at a high enough level (40%), there will be deposited in the bones almost the normal amount of ash in spite of the rachitogenic character of the diet. Certainly lactose has a favorable effect on calcium utilization. Whether this is due to the increased solubility of calcium salts in an acid medium, or to some specific property of lactose itself, is not known. Perhaps the presence of lactose accounts for the fact that the calcium of milk is more completely and readily assimilated than calcium from other sources.

## *Milk Fat, too, is Nutritively Superior*

In view of the fact that both the protein and carbohydrate constituents of milk are nutritively superior it is not surprising that the fat in milk has been proved to surpass other dietary fats.

. . . It is interesting that certain fatty acids, as well as amino acids and vitamins and minerals, have a significant role to play in the complex and fascinating process of animal metabolism. . . .

. . . The rapidity, or ease, of digestion of milk fat is in accord with the observation that patients with gall bladder trouble are able to tolerate butter and cream when they can't digest any other fat.

Recent experimental evidence, using rats as the test animals at this Station . . . and calves at the Minnesota Agricultural Experiment Station . . . indicates that butter has certain nutritive properties not possessed by other fats. It appears that this difference is not due to the presence of vitamins A, D, and E in butter but is probably related to the kinds or quantities of the fatty acids which make up the fats themselves.

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## *Milk Provides Energy along with the Protective Factors*

Milk as a food is well balanced as to calories and protective factors. The following quotations on this point are from the Wisconsin bulletin:

> One quart of milk will provide approximately 665 to 675 calories of energy. . . . The amount of energy that a man needs depends upon several factors, the chief of which is his activity. It takes more calories to play a game of football than it does to sit down and read a book. Young people need more calories than older people, and growing children need still more. . . .
>
> . . . Milk has an especially important place in the diet of people of sedentary occupations and older people. It provides many of the nutritional needs of the body without excessive calories.
>
> Likewise, milk may have a special use in streamlining the figure. Reduction in body weight is all too often accomplished on diets that are extreme in one way or another. A diet composed largely of milk would be better balanced than many reducing diets. . . .

## *Milk is One of the Most Economical of all Foods*

Because of its superior nutritive value, milk is relatively one of the most inexpensive food sources of essential nutrients, the Wisconsin bulletin explains:

> The cow is essentially a medium for the conversion of inexpensive, rough, crude, fibrous foods unsuitable for human consumption into milk, a well balanced, and easily digested human food. The cost of milk depends not only upon the cost of this conversion, but also upon the cost of various processes to which milk is submitted, and the expense of distribution. The price that one must pay for a food is significant only in terms of the food value received for the money expended. An expensive food may be worthless nutritionally, and a cheap food excellent.
>
> Milk at eleven cents a quart costs no more than beef at thirty-five cents a pound as a source of protein, less if we take into consideration the usability of milk proteins in human nutrition. It is an exceptionally inexpensive source of calcium and phosphorus and it supplies vitamins. It is one of the cheapest foods when you consider its excellent nutritive quality. . . .

## *Milk as an Ideal Food Promotes Health Throughout Life*

The bulletin summarizes the facts on the place of milk in nutrition:

> In conclusion we may say that milk is a good all-around food. More than any other food, milk is a well balanced diet delivered in a single package. It is an ideal food to be used by man to promote good health throughout life.